

10 Tips For Efficient Residential Construction



1. BUILDING DESIGN

Efficient building design will cut energy costs significantly. Take plenty of time to develop your building's design by constructing a scale model. This is an easy way to visualize and make changes to the house before the actual building process begins. A good architectural software program will provide significant help during the design phase. Google offers a free downloadable design program at www.sketchup.com. By putting living areas on the south side of the house you can take full advantage of the sun's potential through maximizing natural lighting and heating the areas used most often. The Governors Office of Energy Management and Conservation is a central resource for energy efficient design and construction located at www.buildingenergyinfo.org.

2. SITE ORIENTATION

Effectively orienting the house on the building site is an important part of taking advantage of the sun's heat. The best orientation to maximize solar glazing is within 5 degrees of true south. If this is not possible at your site, it is best to orient the south side of your home more to the east than the west to take advantage of the early morning sun versus the hotter sun of late afternoon. Ideally, the long side of the house with the most glazing should be the side facing south giving the house an east/west orientation. Note any potential obstructions such as trees, other structures, or ridgelines that may cause shading of your home from the South. A good tool to check shading on your site is the Solar Pathfinder www.solarpathfinder.com/. Spend time on the potential building site and observe wind patterns and seasonal sun movement.

3. THERMAL MASS

Utilizing thermal mass is a great way to take advantage of Gunnison Valley's sunny days. Thermal mass acts like a battery, collecting the warmth from the sun during the day and releasing it when you need it at night. This type of system requires a heat mass – which is most effectively achieved by a slab on grade exposed concrete and/or tile/stone covered floor on the entire first floor. Wood and carpet negate the mass storage effect, and reduce effectiveness of infloor heating systems as well. A monolithic frost protected shallow slab will help save money on excavation and forms, labor and concrete. Making your thermal storage concrete slab into a finished floor will save time and money. Davis brand mix in dyes are least toxic and affordable. Make sure to score the floor every 5 feet with a diamond blade saw to provide expansion and contraction cracking zones. Calculate the approximate amount of south facing glass needed by multiplying your entire square footage of the house by 12%. This number equals the amount of square footage of south glass you need to heat the floor without over or under heating the house. When choosing glazing types, consider low E to be the bare minimum, and try to aim for triple pane glazing for new windows. Cover existing windows at night with insulating mass such as insulating window shades, drapes, blinds, or quilts to keep in heat gained during the day.

4. CREATE A TIGHT BUILDING ENVELOPE

Hidden air leaks cause some of the largest heat losses in new and older homes. Make sure the building is well sealed by caulking corners and seams that allow air infiltration. Effectively seal all penetrations in walls such as outlets and switch boxes, plumbing pipes, drains, floors and roofs. Tape building wrap and foam board seams on the exterior walls and roof before siding and roof metal is installed. Also, don't forget to seal and insulate around any ductwork. Other common sites for air leakage include:

- Around new windows and around old window trim.
- Chimney penetrations through insulated ceilings and exterior walls.
- Fireplace dampers.
- Attic access hatches.
- Recessed lights and fans in insulated ceilings.
- Wiring penetrations through insulated floors, ceilings, and walls.
- Window, door, and baseboard moldings.
- Roof/ceiling joints, roof/roof joints, wall/floor joints.
- Crawlspace.
- Dropped ceilings above bathtubs and cabinets.

When building a tight building envelope it is necessary to incorporate a mechanical air-to-air heat exchange ventilation system, in order to circulate fresh air into your home in a controlled manner. This system also helps control humidity levels, which prevents mold and moisture problems in the building.

5. INSULATION

Insulate your building envelope with the best insulation available and to a higher R value than code requires. The key aspect of how well insulation performs is how it is installed. Make sure it is touching the cavity surface on all six sides, but not be crammed or bunched into the space. In the cold climate of Gunnison County properly installed and efficient insulation will pay for itself many times over. To learn about federal tax incentives for adding insulation, visit www.simplyinsulate.com.

Try to move beyond code requirements, as our super cold climate and high energy costs justify to insulate beyond minimums. Here are our recommendations:

- Request R30 in the rim joists and stem walls.
- Shoot for between R25 to R30 in the walls. Some ways to achieve this are:
 - Use closed cell spray foam in a 2x6 wall. (R 6 per inch, ask to see an independent report on R-value).
 - Insulate 2x6 cavity with fiberglass or cotton batts and install 1" (or more) of rigid foam board to the exterior of the building before siding.
 - Buy 8" Structural Insulated Panels (SIP's)
 - Build with natural straw bales that have an insulation value of around R40.

- Roof – try for R50 or more
 - Use raised heeled scissor trusses and insulate 20” or more (blown cellulose insulation is preferred.)
 - Use the thickest size SIP (Structural Insulated Panel) possible.
 - Spray 4” of foam in cavity, and then add R30 batts (R24+R30= R54)
- Slab on grade:
 - Use at least two inches of Dow Board (R10) underneath slabs.
 - Use at least R20 around the exterior perimeter. Glue two sheets of 2” Dow board together and then glue to wall using non-toxic glue.

6. WINDOWS AND DOORS

Up to 25% of heat loss in a building is through the windows and doors. Using low-e triple paned windows and insulated doors is more expensive, but they save a significant amount of energy in the long run. Windows should have a u-value of 0.35 or lower. Exterior doors with an insulated core are 60% more efficient than solid wood doors. Don’t overlook the efficiency of your doors – choose at least an R8 for your doors. Make sure your patio doors are as efficient as your windows – patio doors are much more airtight than sliding doors. Here are some good sites for more information about windows and doors.

- www.efficientwindows.org/ informs about tax credits for efficient windows.
- cpd.nfrc.org/pubsearch/psMain.asp has information from the National Fenestration Ratings Council. Check windows by make, model and manufacturer.
- www.magnetite.com/faq.html is a website for interior storm windows, a fast payback alternative to new windows.

7. DAYLIGHTING AND CFL’S

Effective use of daylight can help to cut down on electric use during the day. This includes using light shelves, putting windows on adjacent walls, skylights, and sun tubes.

For other lighting needs, compact fluorescent light bulbs (CFLs) are 4-6 times more efficient than incandescent light bulbs and last up to ten times longer, saving \$30 or more over the lifetime of the bulb. When changing out multiple bulbs in one room, select ENERGY STAR qualified bulbs with the same color and manufacturer to ensure more consistent light color. Make sure you choose the right light for the right place by reading the bulb’s packaging. For popular recessed ceiling fixtures, choose a CFL bulb made for this application. Make sure that CFL bulbs purchased for outside lighting are clearly labeled “Outdoor Use”, as they are designed for extreme temperatures. If the bulb will be directly exposed to moisture make sure it is “Wet Location” listed. In addition, only a handful of CFL bulbs currently work well on dimmer and remote switches, or come with a 3-way switching feature, but they are available.

Just like incandescent bulbs, you will find ENERGY STAR qualified CFL bulbs labeled soft white, cool white, or daylight. When selecting a new CFL bulb, it is a good idea to use the same color type as the incandescent you are replacing. Another way to do this is to look for the scientific color designation known as correlated color temperature (CCT)

measured in Kelvin (K) on the packaging: 2,700K, 3,000K, 5,100K, etc. Lower CCT numbers mean the light will be warmer white, while higher numbers mean it will be cooler light.

Here are a few websites that have a variety of bulbs to choose from:

www.buylighting.com, www.bulbbarn.com, and www.1000bulbs.com have a variety of bulbs to choose from. www.energystar.gov has a “savings calculator” where you can figure out the savings in your home if you changed over to CFL bulbs.

8. APPLIANCES

Choosing energy efficient appliances will reduce your home’s overall energy footprint while lowering your energy bill. Front loading, Energy Star qualified washers use 50% less energy than standard washers. A good resource is Energy Star’s “savings calculator” at www.energystar.gov. Here you can compare various appliances, product payback times and potential energy savings. Refrigerators that are Energy Star qualified use 15% less energy than required by federal standards and an amazing 40% less energy than conventional models sold in 2001. Energy Star qualified dishwashers use 25% less energy than federal minimum energy standards for energy consumption. In addition to using less energy, Energy Star dishwashers also use far less water. Visit www.aceee.org/consumerguide for reviews on all these different appliances.

9. SOLAR THERMAL AND SOLAR ELECTRIC SYSTEMS

When looking at other ways to reduce the cost of energy of a home, solar thermal (hot water) and solar electric (photovoltaic) systems are cost effective over the long term and make a huge difference on your home’s overall energy costs. In conjunction with implementing the above tips, it is possible to live in a home that produces as much energy as it uses. According to the US Department of Energy’s Energy Efficiency and Renewable Energy website www.eere.energy.gov, a solar hot water heating system can reduce the need for conventional hot water heating by up to two thirds. These systems work well in conjunction with on demand hot water heaters, high efficiency boilers, or side-arm systems as a pre-heat for domestic hot water (DHW). Solar electric systems will offset your total electrical usage when you subscribe to net-metering with your local electric provider, Gunnison County Electric Association (GCEA). www.energytaxincentives.org explains tax credits for both types of systems.

10. HEALTHY BUILDING MATERIALS

Making sure the building materials are from a local source when feasible is a great way to cut down on consumption during the building process. Also, choosing products that are not harmful to the environment and to the occupants of the house is very important. Look for low or zero VOC (Volatile Organic Compound) paints, stains, finishes, and grout sealants. You should request formaldehyde free OSB, plywood, adhesives, carpet, joint compound, and cabinets – just to name a few. Visit www.builtgreen.org or www.buildinggreen.com for more ideas on healthy building materials.